

## **Comparative study of dexmedetomidine and clonidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block for upper limb surgeries in a tertiary care centre**

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**Conflicts of Interest:** Nil

### **Abstract**

**Introduction:** In supraclavicular Brachial plexus block addition of adjuvants in local anaesthetic helps to faster onset of sensory and motor block. We compare efficacy of Clonidine and Dexmedetomidine as adjuvant to Bupivacaine in supraclavicular brachial plexus block.

**Method:** After approval from the institutional ethical committee in study period of 18 months, 100 individuals were selected by systematic random sampling, aged from 18 to 60 years of both sexes belonging to ASA I-II were scheduled for upper limb surgery with written informed consent taken and divided into two groups of 50 each-Group I: Bupivacaine 0.25%(30cc)+Clonidine 1mcg/kg. Group II: Bupivacaine 0.25% (30cc)+Dexmedetomidine 1mcg/kg. The patients were compared for onset of sensory and motor blockade and hemodynamic side effects. For statistical analysis chi-

square test and ANOVA test were used. **Results:** The mean of age, weight, duration of surgery, distribution of sexes and ASA between two groups were comparable. The onset of sensory and motor block was found to be significant in group II compared to group I. In some patients of group II bradycardia hypotension was noted. **Conclusion:** In present study it was found that addition of Dexmedetomidine is a better alternative to Clonidine as an adjuvant for 0.25% Bupivacaine to obtain early onset of sensory and motor block.

**Keywords:** Supraclavicular block, Bupivacaine, Dexmedetomidine, Clonidine, Onset of block.

### **Introduction**

Supraclavicular brachial plexus block is a common regional anaesthetic technique used to provide anaesthesia and analgesia for upper extremity surgery<sup>1</sup>. Upper limb surgeries are mostly performed

under brachial plexus block (BPB) which avoids the unwanted effects of anaesthetic drugs, stress of laryngoscopy and tracheal intubation, and also extend analgesia in the post-operative period without any systemic side effects such as nausea, vomiting, and respiratory depression<sup>2,3</sup>. Supraclavicular approach for BPB gives the most effective block for all portion of upper extremity<sup>4,5</sup>.

Peripheral nerve blocks not only provide intra-operative anaesthesia but also extend analgesia in the postoperative period without any systemic side-effects<sup>6</sup>. The brachial plexus block is one among the most popular regional nerve blocks performed for upper limb surgeries. Supraclavicular approach for brachial plexus block is most commonly suitable for upper limb surgeries and postoperative pain relief. Local anaesthetic drugs like Lignocaine, Bupivacaine, Levobupivacaine and Ropivacaine are used in peripheral blocks and along with it various additive drugs like opioids such as Fentanyl, Dexmedetomidine, Dexamethasone, Clonidine are used with local anaesthetics as adjuvants to prolong the duration of post operative analgesia and improve the quality of intra operative analgesia clonidine<sup>7</sup> allows the reduction of the amount of local anaesthetic and thus the incidence of side effects<sup>8,9</sup>. Dexmedetomidine, an  $\alpha_2$ -receptor agonist, with  $\alpha_2/\alpha_1$  selectivity 8 times than that of clonidine has also been reported to improve the quality of intrathecal and epidural anaesthesia<sup>1,10,11</sup> when used along with LA as adjuvant. Adjuvant to local anaesthetics for brachial plexus block may enhance the quality and duration of analgesia<sup>12</sup>. Various clinical trials have found that administration of Dexmedetomidine with local anaesthetics in neuraxial and peripheral nerve blocks prolonged the duration of sensory and motor blockade.

The anaesthetic and analgesic requirement get reduced to huge extent by the use of Dexmedetomidine<sup>14</sup> because of its analgesic properties and augmentation of local anaesthetic effects as they cause hyperpolarisation of nerve tissue by altering transmembrane potential and ion conductance in brainstem. Also has stable hemodynamic and decreased oxygen demand and excellent post-operative analgesia making it useful pharmacologic agent. Hence Dexmedetomidine is selected as adjuvant to local anaesthetics in brachial plexus block in our study.

Clonidine, an imidazoline,  $\alpha_2$  adrenoreceptor agonist, has been extensively studied as an adjuvant to local anesthetic in peripheral nerve blocks also as antihypertensive activity. Neuraxial placement of clonidine inhibits substance P release and nociceptive neuron firing produced by the noxious stimulation and thus produces analgesic effect. Clonidine has the ability to modify the potassium channels in the CNS and hyperpolarize the membranes. So it reduces the anaesthetic requirements<sup>15</sup>. Thus clonidine is selected as adjuvant to local anaesthetics in brachial plexus block in our study.

Our study compares addition of Dexmedetomidine and Clonidine to Bupivacaine for supraclavicular brachial plexus block in upper limb orthopaedic surgery.

### Materials and Methods

This study was conducted in Department of Anaesthesia, in operation theatre of a Government Tertiary Care Hospital during the period of December 2020 to October 2022. It included 100 patients undergoing elective surgery of the upper limb. It was a Hospital based analytical Prospective, Randomized Double-Blind comparative study. Randomization was done with sealed envelope technique. Sample size of 100 individuals was

selected by Andrew's Fisher formula. Patient's age criteria were 18 to 60 years of both sexes belonging to ASA I-II. The patients were randomly divided into two groups each of 50 patients by sealed envelope method. The medications were prepared by another person so that patient and the person doing the study did not know in which group a particular patient had been allotted.

Group I: Bupivacaine 0.25%(30cc)+Clonidine 1mcg/kg.

Group II: Bupivacaine 0.25%(30cc)+Dexmedetomidine 1mcg/kg.

Equipment's included peripheral nerve stimulator of B Braun with 22-gauge, 5cm, short-bevel insulated needle. The assessment of study had following parameters.

#### 1. Assessment of Sensory block:

It was assessed by cold sensation method. Assessment of sensory block was done at each minute in random sequence after completion of drug injection in the dermatomal areas corresponding to median nerve, radial nerve, ulnar nerve and musculocutaneous and compared with the contralateral limb. Sensory block was evaluated by

1=normal sensation of pinprick.

2=pin prick felt as sharp point, but weaker compared with same area in the other upper limb.

3=pin prick recognised as touch with blunt object.

4=no perception of pin prick.

#### Onset time of sensory block

The time between completion of the local anaesthetic administration till the sensory block started appearing i.e. score=2.

#### 2. Assessment of motor block

It was carried out by the same observer at each minute till complete motor blockade after drug injection. Onset of motor blockade was considered when there was Grade

2 motor blockade. Complete motor block was considered when there was Grade 4 motor blockade. Motor block was determined according to a Hollmen scale for upper extremities on a 4-point scale.

#### Motor block

1=normal motor function.

2=Weak motor function.

3=very weak motor action.

4=complete loss of motor action.

#### Onset time of motor block

It is the time between completions of the local anaesthetic administration till grade 2 on hollmen scale.

Patients were monitored for haemodynamic variables such as heart rate, blood pressure and oxygen saturation every 5 mins for first 15 mins. Next every 15 min till the completion of surgery. Intraoperative complications, if any, including vessel injury, haematoma, nausea and vomiting, dyspnea, fall in respiratory rate or oxygen saturation, any symptom/sign of LA toxicity, ECG changes, Horner's syndrome, sedation, etc were recorded, with their respective management.

#### Observations and Results

Following observations were made in our study:

Mean of age, mean of weight, mean duration of surgery, distribution of sexes and ASA between the two groups were comparable.

Mean duration for below parameters was found significant in group II when compared to group I as shown in Figure 1 and Figure 2.

Comparison of onset of sensory block and motor block was done for two groups as shown in Table 1 and Table 2.

Table 1: Comparison of onset of sensory block between two groups

Groups	N	Sensory block onset in min.(mean)	SD	T-value	P-value
Group 1	50	6.25	0.701	7.065	<0.0001
Group 2	50	5.27	0.686		

Table 1: shows that there is significant difference between mean time for onset of sensory block in Group 1 (Clonidine) and Group 2 (Dexmedetomidine). Onset of sensory block was faster in Group 2 (5.27±0.68 min) when compared to Group 1 (6.25 ± 0.70 min). Unpaired t test was applied (T=7.06). The difference was statistically highly significant p<0.001.

Figure 1: Onset of Sensory Block between two groups

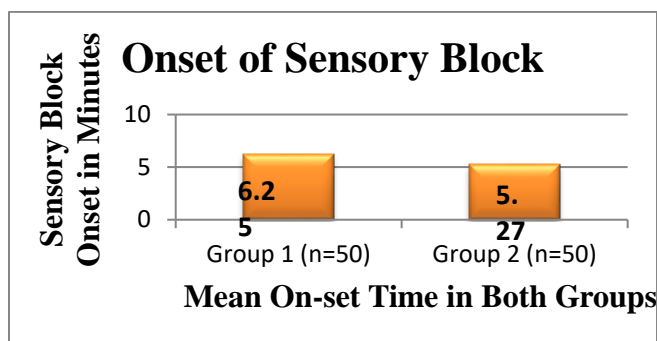


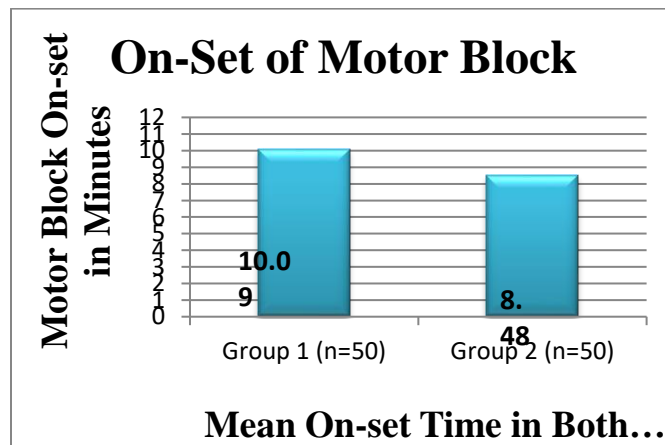
Table 2: Comparison of onset of motor block between two groups

Groups	N	Motor block onset in min.(mean)	SD	T-value	P-value
Group 1	50	10.09	0.697	11.784	<0.0001
Group 2	50	8.48	0.669		

Table 2: shows that there is significant difference between mean time for onset of motor block in Group 1 (Clonidine) and Group 2 (Dexmedetomidine). Time for onset of motor block was faster in Group 2(8.48±0.66 min) compared to Group 1 (10.09±0.69 min).Unpaired t

test was applied (T=11.78.) The difference was statistically highly significant p<0.001.

Graph 2: Onset of motor block in two Groups



### Discussion

#### Demographic Profile

Age of The Patients: In our study, the mean age of patients in Group 1 was 37.16 ± 11.07 years. Mean age of patients in Group 2 was 36.34 ±12.29 years.Using unpaired ‘t’ test; there was no significant difference in the two groups statistically (p >0.05). (Table 1)

Weight of Patients: In our study the weights of the patients in both the Groups were comparable. Mean weight in Group 1 was (57.82 kg) and in Group 2 was (57.76 kg) (p >0.05). There was no significant difference between the two groups. (Table 2a). Many studies were performed in the past having similar mean weights of the patients to ours.

Sex Distribution of Patients: In our study there were more male patients than female patients in both the Groups. In Group 1 we had 27 males and 23 females. While in Group 2 we had 26 males and 24 females (p>0.05).There was no significant difference regarding the sex distribution between two groups. (Table 3).

Onset of Sensory Blockade: In our study the mean onset of sensory block in Group 1 was 6.25 ± 0.70

minutes. The mean onset of sensory block in Group 2 was  $5.27 \pm 0.68$  minutes.

Using unpaired 't' test; there was highly significant difference in the two groups statistically ( $p < 0.001$ ). (Table 2)

Onset of Motor Blockade: In our study the mean onset of motor blockade in Group 1 was  $10.09 \pm 0.69$  minutes. The mean onset of motor blockade in Group 2 was  $8.48 \pm 0.66$  minutes. Using unpaired 't' test; there was highly significant difference in the two Groups statistically ( $p < 0.001$ ). (Table 6)

### Conclusion

From our study of comparison of Dexmedetomidine and Clonidine adjuvant to Bupivacaine in supraclavicular block we can derive the following conclusion.

- Dexmedetomidine when added to Bupivacaine provides early onset of sensory block, as compared to Clonidine.
- Dexmedetomidine when added to Bupivacaine provides early onset of motor block, as compared to Clonidine.
- Dexmedetomidine can cause bradycardia though such incidences are very low. Clonidine is devoid of such complications. Other side effects like nausea, vomiting is not seen with either of the drugs used in our study.

### List of Abbreviations Used

1. ASA - American Society of Anaesthesiology
2. PR - Pulse Rate
3. SBP - Systolic Blood Pressure
4. DBP - Diastolic Blood Pressure
5. MAP - Mean Arterial blood Pressure
6. SPO<sub>2</sub> - Saturation of Oxygen
7. DOS - Duration of Surgery
8. OTSB - Onset Time of Sensory Block

9. OTMB - Onset Time of Motor Block
10. DOSB - Duration of Sensory Block
11. DOMB - Duration of Motor Block
12. DOA - Duration of Analgesia
13. QOB - Quality of Block
14. VAS - Visual Analogue Score
15. RA - Rescue Analgesia
16. RSS - Ramsay Sedation Scale
17. Hrs - Hours
18. Mins - Minutes
19. Kgs - Kilograms
20. Vs - Versus
21. IV - Intravenous
22. Yrs - Years
23. SD - Standard deviation

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